

IN THE CLAIMS:

Please amend the claims so as to read as follows:

1. (Currently Amended) An active-matrix image display device which includes a power supply of a charge-pump system, and drivers which come into operation in response to a supply of power from the power supply to drive display cells, said drivers having two operational modes including a scanning mode in which a video signal is applied to any of the display cells, and a hold mode in which no video signal is applied to the display cells, said active-matrix image display device comprising:

mode switching means for periodically changing the operation modes so that a duration of the hold mode is equal to or longer than a duration of the scanning mode; and

control means for switching, according to the operational modes, a frequency at which pump operation of the power supply is activated.

2. (Currently Amended) The active-matrix image display device as set forth in claim 1, wherein:

~~an~~ a maximum of the operating current value in the scanning mode of the drivers and an operating current value in the hold mode of the drivers differ by 10 times or more, and

a said frequency ~~of the pump operation is decided at which~~ pump operation of the power supply is activated by said control means is established according to a said maximum value of the operating current values of the drivers, and

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~~circuit elements of the said power supply are arranged~~
~~according to the~~ is configured so as to provide high
conversion efficiency at said frequency of the pump
~~operation.~~

3. (Original) The active-matrix image display device as set forth in claim 1,
wherein
said power supply includes a first oscillator which generates a first clock
signal which is used as a reference in the pump operation of the power
supply in the scanning mode.
4. (Original) The active-matrix image display device as set forth in claim 3,
wherein said power supply includes a divider which divides the first clock
signal to generate a second clock signal which is used as a reference in
the pump operation of the power supply in the hold mode.
5. (Original) The active-matrix image display device as set forth in claim 3,
wherein:
said power supply includes an input terminal for inputting a
second clock signal which is used as a reference in the
pump operation of the power supply in the hold mode, and
oscillator control means for inactivating operation of the first
oscillator during at least a part of a period of the pump
operation operated by the second clock signal.

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6. (Original) The active-matrix image display device as set forth in claim 3,
wherein:

said power supply includes a second oscillator which generates a
second clock signal which is used in the pump operation of
the power supply in the hold mode, and
oscillator control means for inactivating operation of the first
oscillator during at least a period of the pump operation
operated by the second clock signal.

7. (Original) The active-matrix image display device as set forth in claim 1,
wherein the scanning mode and the hold mode are repeated periodically
with a period of several hundred msec.

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8. (Original) The active-matrix image display device as set forth in claim 1,
wherein a period of the hold mode is set to be several times to several ten
times longer than a period of the scanning mode.

9. (Original) The active-matrix image display device as set forth in claim 1,
wherein said control means makes up said mode switching means, and,
when increasing frequency, switches the frequency in advance a
predetermined time interval before switching of the operation modes, so
that the increase of frequency is finished by the time the switching of the
operation modes is started.

10. (Original) The active-matrix image display device as set forth in claim 1, wherein among power consumption of an image display section including the display cells and drivers, power consumption in the hold mode is lower than power consumption of the control means and the power supply itself in the scanning mode.

11. (Original) The active-matrix image display device as set forth in claim 1, comprising:

a first power supply for multiplying an input voltage by a predetermined constant factor;

a regulator for generating a first voltage by stabilizing an output voltage of the first power supply to a predetermined value, and supplying the first voltage to the drivers; and

a second power supply for generating a second voltage by multiplying the first voltage by a predetermined constant factor, and supplying the second voltage as an ON voltage or an OFF voltage to a scanning signal line driver, which is one of the drivers,

wherein at least one of the first power supply and the second power supply makes up the power supply under control of the control means.

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12. (Currently Amended) The active-matrix image display device as set forth in claim 1, comprising:

a first power supply for raising an input voltage by a predetermined factor;

a regulator for generating a first voltage by stabilizing an output voltage of the first power supply to a predetermined value, and supplying the first voltage to the drivers;

a second power supply for raising the first voltage by a predetermined factor, and supplying the first resulting voltage as an ON voltage of a scanning signal line driver, which is one of the drivers; and

a third power supply for inverting and raising the first voltage by a predetermined factor, and supplying the first resulting voltage as an OFF voltage of to the scanning signal line driver, which is one of the drivers,

wherein at least one of the first power supply, the second power supply, and the third power supply makes up the power supply under control of the ~~power supply~~ control means.

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13. (Currently Amended) Portable electrical equipment with an image display device, said image display device being an active-matrix image display device which includes a power supply of a charge-pump system, and drivers which come into operation in response to supply of power from the power supply to drive display cells, said drivers having two operation modes including a scanning mode in which a video signal is applied to any of the display cells, and a hold mode in which no video signal is applied to the display cells said image display device comprising:

mode switching means for periodically changing the operation modes so that a duration of the hold mode is equal to or longer than a duration of the scanning mode; and

control means for switching, according to the operational modes, a frequency at which pump operation of the power supply is activated.

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14. (Currently Amended) An active-matrix image display device which includes a power supply of a charge-pump system, and drivers which come into operation in response to supply of power from the power supply to drive display cells, said drivers having two operational modes including a scanning mode in which a video signal is applied to any of the display cells, and a hold mode in which no video signal is applied to the display cells, said power supply maintaining an output voltage value by a smoothing capacitor which is maintained at an output of the power supply while the pump operation is inactive, said power supply including:

control means for stopping the pump operation of the power supply according to the hold mode, and

mode switching means for periodically changing the operation modes so that a duration of the hold mode is equal to or longer than a duration of the scanning mode.

15. (Original) The active-matrix image display device as set forth in claim 14, wherein the scanning mode and the hold mode are periodically repeated with a period of several hundred msec.

16. (Currently Amended) The active-matrix image display device as set forth in claim 14, wherein

said mode switching means periodically switches the operation modes so that duration of the hold mode becomes equal to or longer than duration of the scanning mode, and

~~a drop margin of any decrease in~~ the output voltage value of the power supply present when pump operation is resumed at the time of a switch from the hold mode to the scanning mode is not more than 10% of an output voltage value to be maintained.

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17. (Currently Amended) The active-matrix image display device as set forth in claim 14, wherein said mode switching means switches the operation modes so that a duration of the hold mode becomes equal to or longer than a duration of the scanning mode, and a recovery time required for an output voltage value which dropped while the pump operation was inactive to return to the output voltage value to be maintained from resumption of the pump operation is within several ten msec, and the scanning mode and the hold mode are periodically repeated with a period of several hundred msec.

18. (Currently Amended) The active-matrix image display device as set forth in claim 14, wherein:

an operating current value in the hold mode of the drivers is not more than 0.01 times an operating current value in the scanning mode, and

said mode switching means switches the operation modes so that a duration of the hold mode becomes equal to or longer than a duration of the scanning mode, and the scanning mode and the hold mode are periodically repeated with a period of several hundred msec.

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19. (Original) The active-matrix image display device as set forth in claim 14, wherein a period of the hold mode is set to be several times to several ten times longer than a period of the scanning mode.

20. (Currently Amended) The active-matrix image display device as set forth in claim 14, wherein said control means makes up said mode switching means, and, when resuming pump operation, resumes the pump operation in advance of a predetermined time interval before switching of the operation modes, so that resumption of pump operation is finished by the time the switching of the operation modes is started.

21. (Original) The active-matrix image display device as set forth in claim 14, wherein among power consumption of an image display section including the display cells and the drivers, power consumption in the hold mode is lower than power consumption of the control means and power supply itself in the scanning mode.

22. (Currently Amended) The active-matrix image display device as set forth in claim 14, comprising:

a first power supply for multiplying an input voltage by a predetermined constant factor;

a regulator for generating a first voltage by stabilizing an output voltage of the first power supply to a predetermined value, and supplying the ~~first~~ resulting voltage to the drivers; and

a second power supply for generating a second voltage by multiplying the first voltage by a predetermined constant factor, and supplying the ~~second~~ resulting voltage as an ON voltage or an OFF voltage to a scanning signal line driver, which is one of the drivers,

wherein at least one of the first power supply and the second power supply makes up the power supply under the control of the control means.

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23. (Currently Amended) The active-matrix image display device as set forth in claim 14, comprising:

a first power supply for raising an input voltage by a predetermined factor;

a regulator for generating a first voltage by stabilizing an output voltage of the first power supply to a predetermined value, and supplying the first voltage to the drivers;

a second power supply for raising the first voltage by a predetermined factor, and supplying the first resulting voltage as an ON voltage of a scanning signal line driver, which is one of the drivers; and

a third power supply for inverting and raising the first voltage by a predetermined factor, and supplying the first resulting voltage as an OFF voltage ~~of~~ to the scanning signal line driver, which is one of the drivers,

wherein at least one of the first power supply, the second power supply, and the third power supply makes up the power supply under control of the ~~power supply~~ control means.

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24. (Currently Amended) Portable electrical equipment with an image display device, said image display device being an active-matrix image display device which includes a power supply of a charge-pump system, and drivers which come into operation in response to supply of power from the power supply to drive display cells, said drivers having two operational modes including a scanning mode in which a video signal is applied to any of the display cells, and a hold mode in which no video signal is applied to the display cells, said power supply maintaining an output voltage value by a smoothing capacitor which is maintained at an output of the power supply while the pump operation is inactive, said image display device comprising:

control means for stopping the pump operation of the power supply according to the hold mode, and
mode switching means for periodically changing the operation modes so that a duration of the hold mode is equal to or longer than a duration of the scanning mode.

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25. (New Claim) An active-matrix image display device as set forth in claim 1, wherein, when power consumption is to be reduced, said drivers increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

26. (New Claim) An active-matrix image display device as set forth in claim 13, wherein, when power consumption is to be reduced, said drivers increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

27. (New Claim) An active-matrix image display device as set forth in claim 14, wherein, when power consumption is to be reduced, said drivers increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

28. (New Claim) An active-matrix image display device as set forth in claim 24, wherein, when power consumption is to be reduced, said drivers increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

29. (New Claim) An active-matrix image display device as set forth in claim 1, wherein, when power consumption is to be reduced, said drivers insert a hold mode in the scanning mode that is an operation mode under normal driving conditions of said device so as to increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

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30. (New Claim) An active-matrix image display device as set forth in claim 13, wherein, when power consumption is to be reduced, said drivers insert a hold mode in the scanning mode that is an operation mode under normal driving conditions of said device so as to increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

31. (New Claim) An active-matrix image display device as set forth in claim 14, wherein, when power consumption is to be reduced, said drivers insert a hold mode in the scanning mode that is an operation mode under normal driving conditions of said device so as to increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

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32. (New Claim) An active-matrix image display device as set forth in claim 24, wherein, when power consumption is to be reduced, said drivers insert a hold mode in the scanning mode that is an operation mode under normal driving conditions of said device so as to increase a vertical scanning period of said display so as to be longer than a normal vertical scanning period of said device.

33. (New Claim) The active-matrix image display device as set forth in claim 1, wherein:

a maximum of the operating current value in the scanning mode of the drivers and an operating current value in the hold mode of the drivers differ by 10 times or more,

said frequency at which pump operation of the power supply is activated by said control means is established according to said maximum value of the operating current values of the drivers, and

the maximum values of the operating current values and the frequency at that maximum value determine a capacitance of a capacitor and a capacitance of a smoothing capacitor for pump operation, and also determine the configuration of a switching element for switching said capacitor for pump operation, and

said frequency at said maximum value determines a capacitance and a resistance of a CR oscillator that constitutes a clock generator for generating a clock signal to be fed to the switching element.

Almont